



CGAL periodic volume mesh generator

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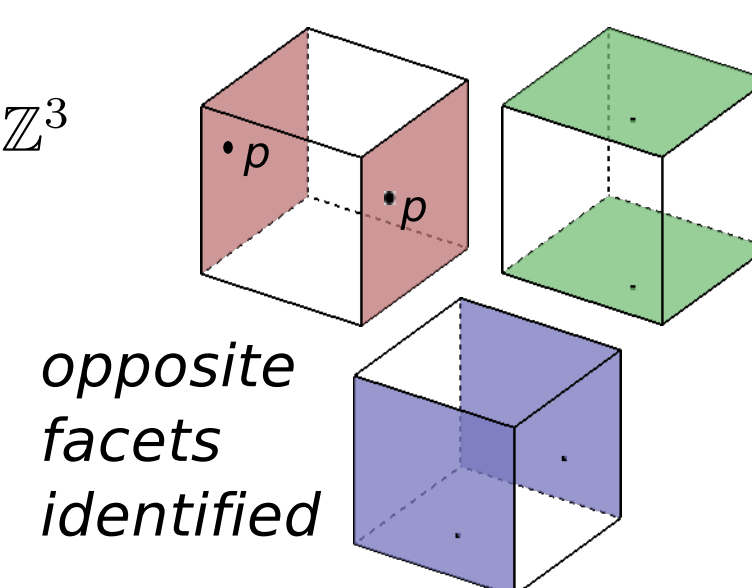
Submitted on 9 Dec 2014

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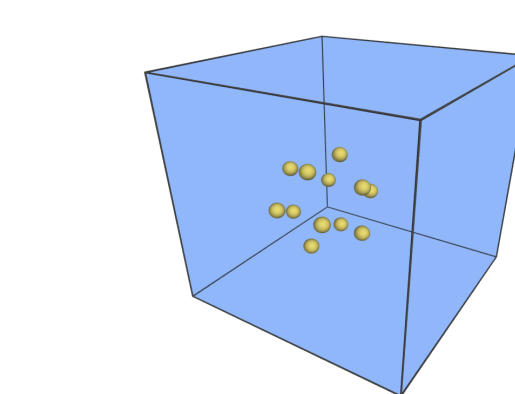
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Periodic Delaunay triangulation [CT09]

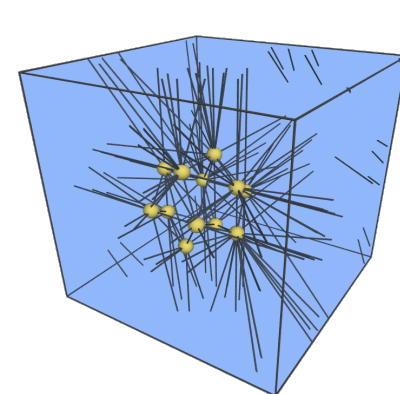
Flat torus : $\mathbb{T}^3 = \mathbb{R}^3 / \mathbb{Z}^3$



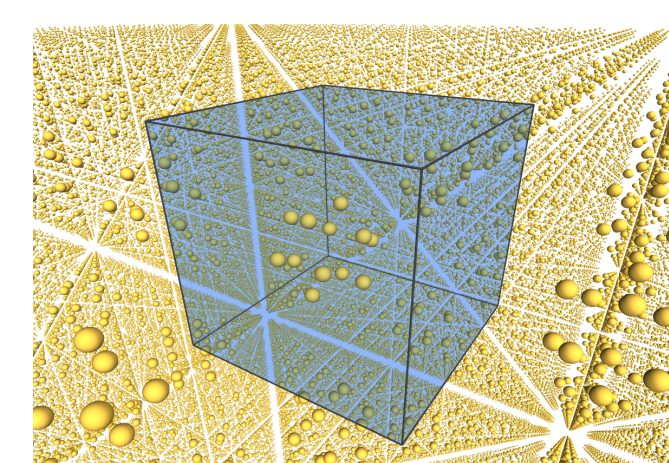
A finite computation
for an infinite structure



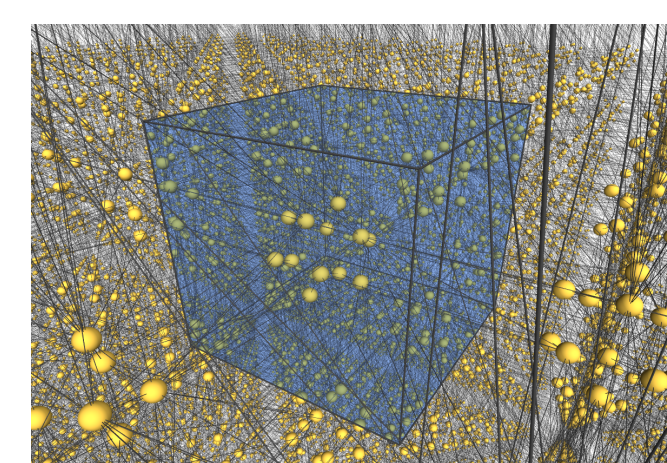
\mathcal{P}
Input point set



$DT_{\mathbb{T}}(\mathcal{P})$
Delaunay triangulation in \mathbb{T}^3



$\mathcal{P} + \mathbb{Z}^3$
Infinite point set



$DT(\mathcal{P} + \mathbb{Z}^3)$
Infinite Delaunay triangulation

Triangulation

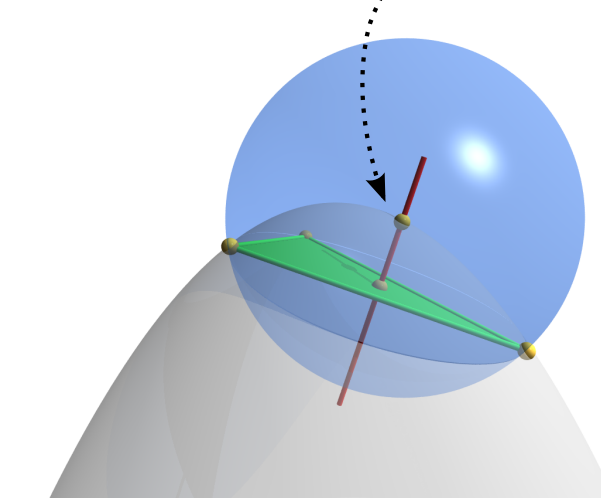
Volume mesh [RY07]

Delaunay Refinement

Criteria

- Shape
- Size
- Distance

while (**is_bad**(simplex))
 refine(simplex);

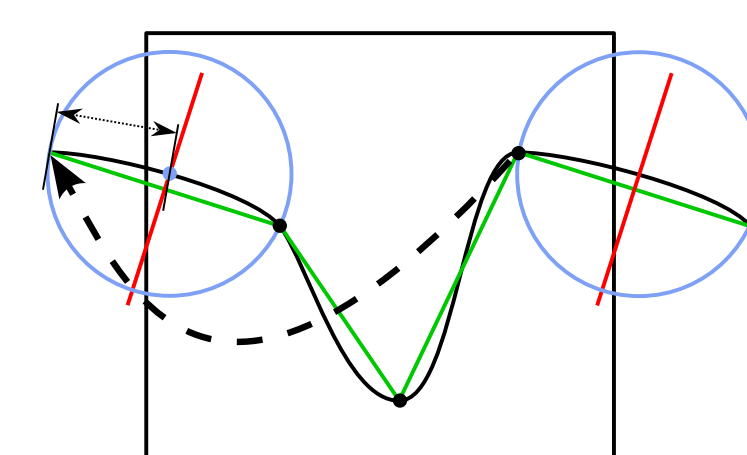


Restricted Delaunay
Triangulation
(case of a facet)

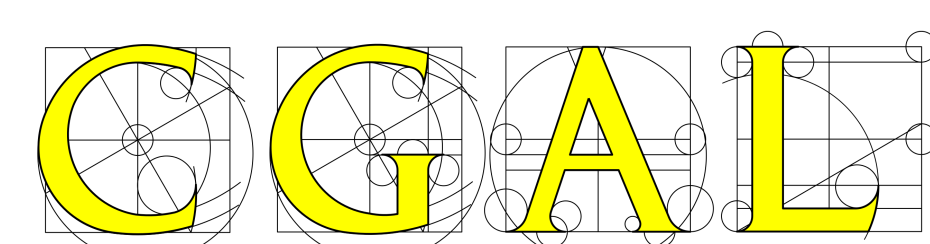


Criteria

Periodic refinement criteria



Evaluate the simplex quality
using translated vertices



www.cgal.org



Computational Geometry Algorithms Library

- Open source
- Templated C++ (genericity)
- Robust, Efficient
- Cross-platform
- Academic and Industrial users
- Dual License (GPL & commercial)
- Large variety of packages

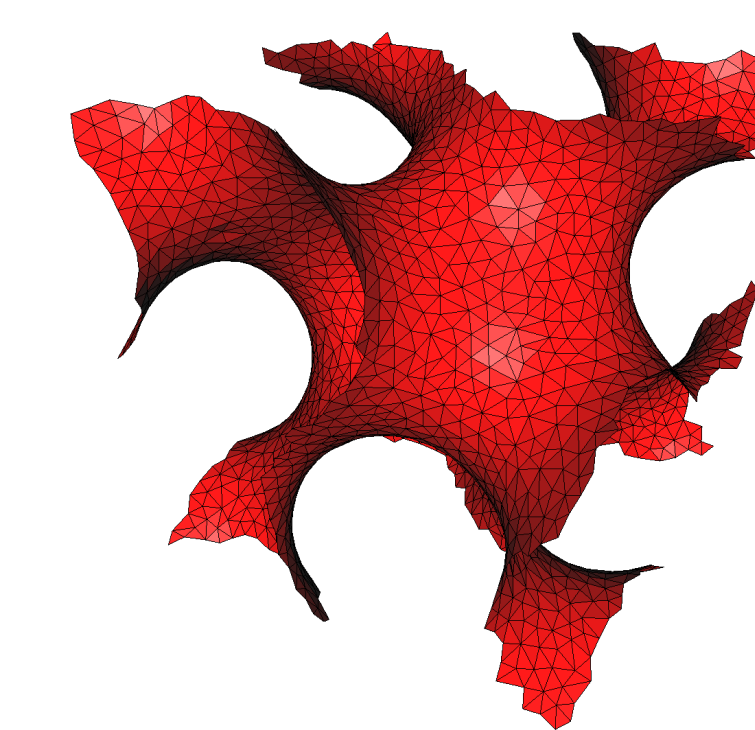
In progress

- Meshes on sphere
- Hyperbolic meshes
- Anisotropic meshes
- ...

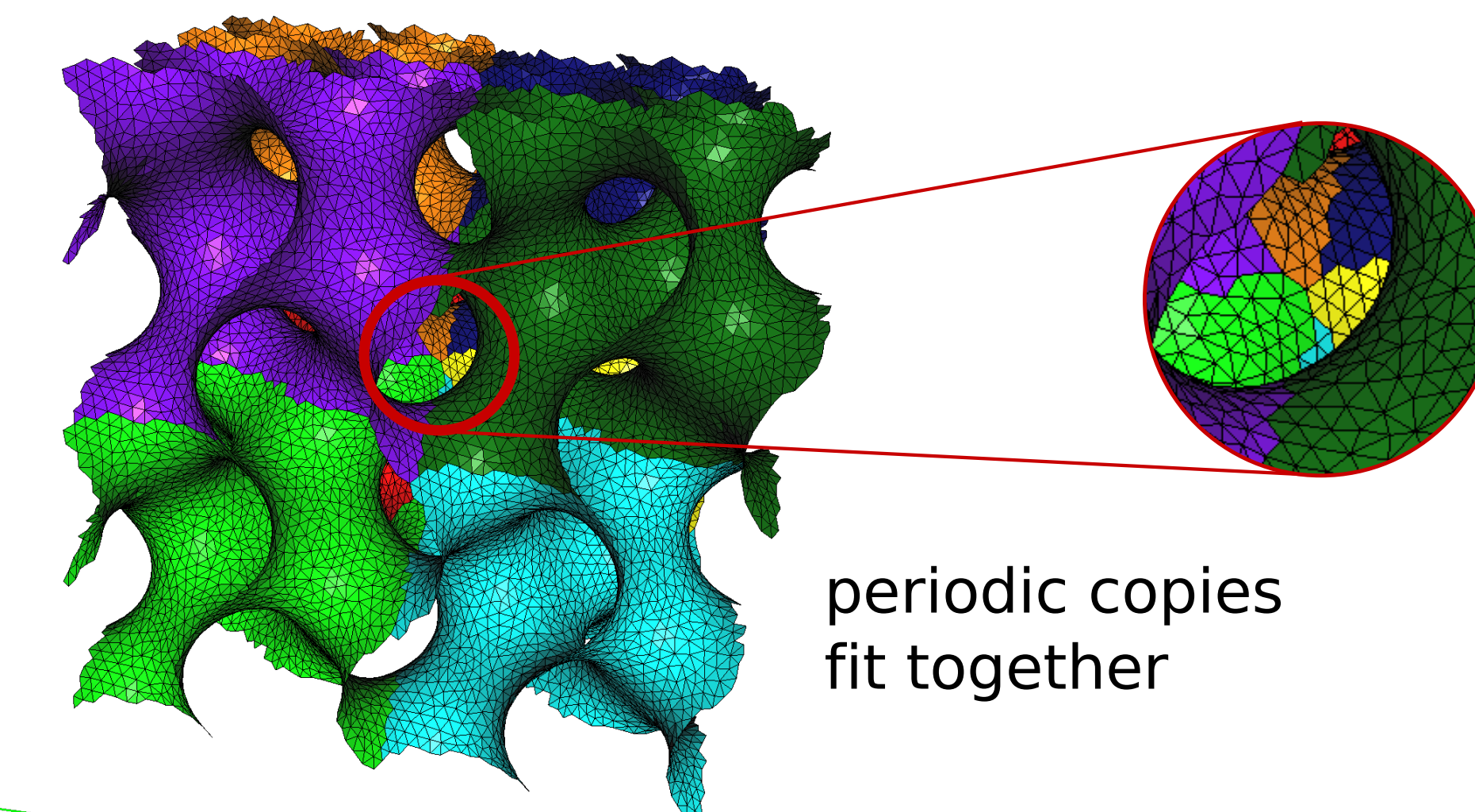


Manuel Caroli and Monique Teillaud.
3D Periodic Triangulations

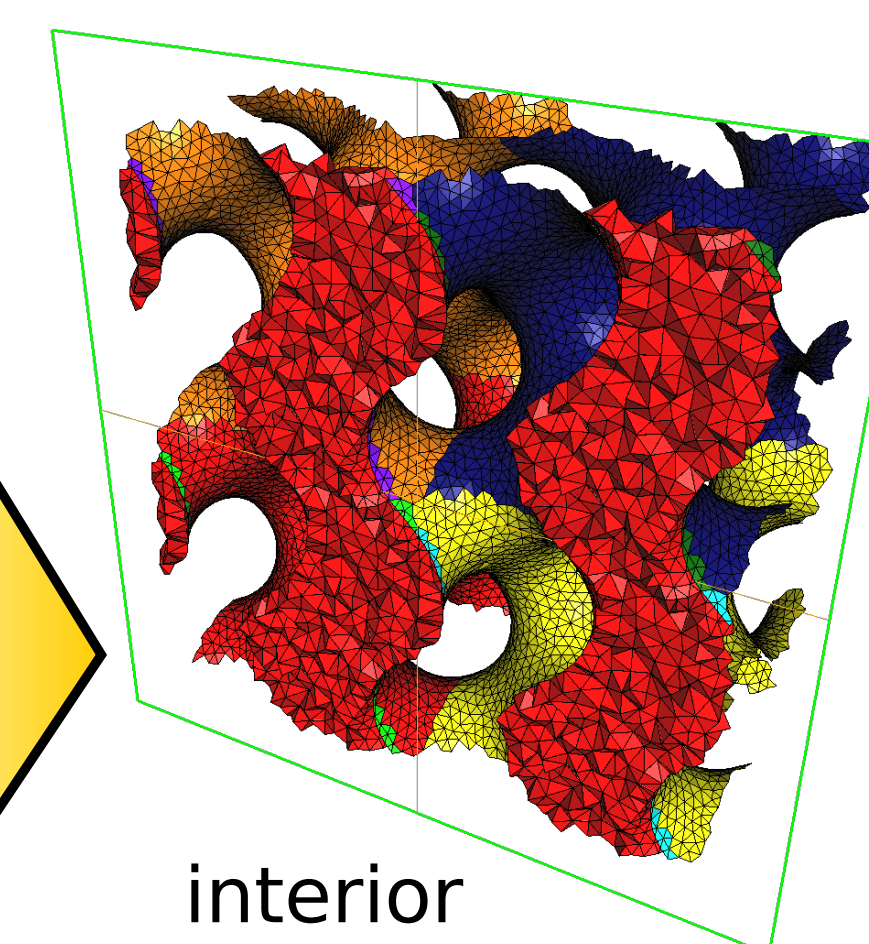
Pierre Alliez, Clément Jamin, Laurent Rineau, Stéphane Tayeb, Jane Tournois, Mariette Yvinec
3D Mesh Generation



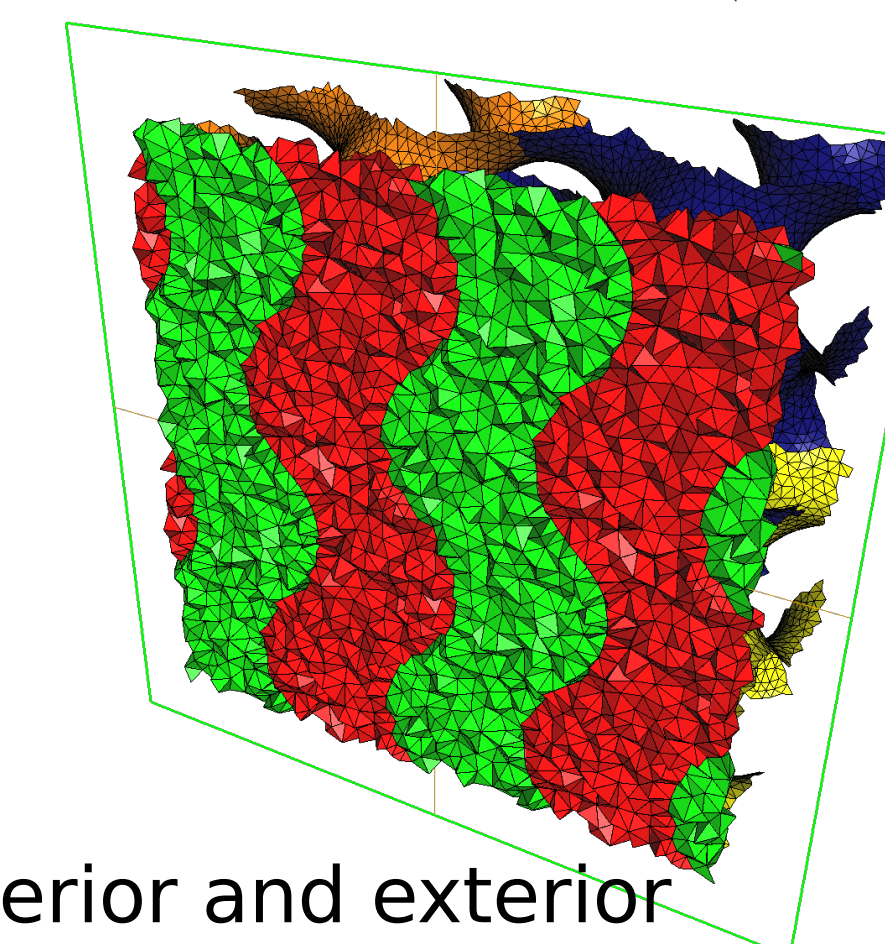
one copy computed



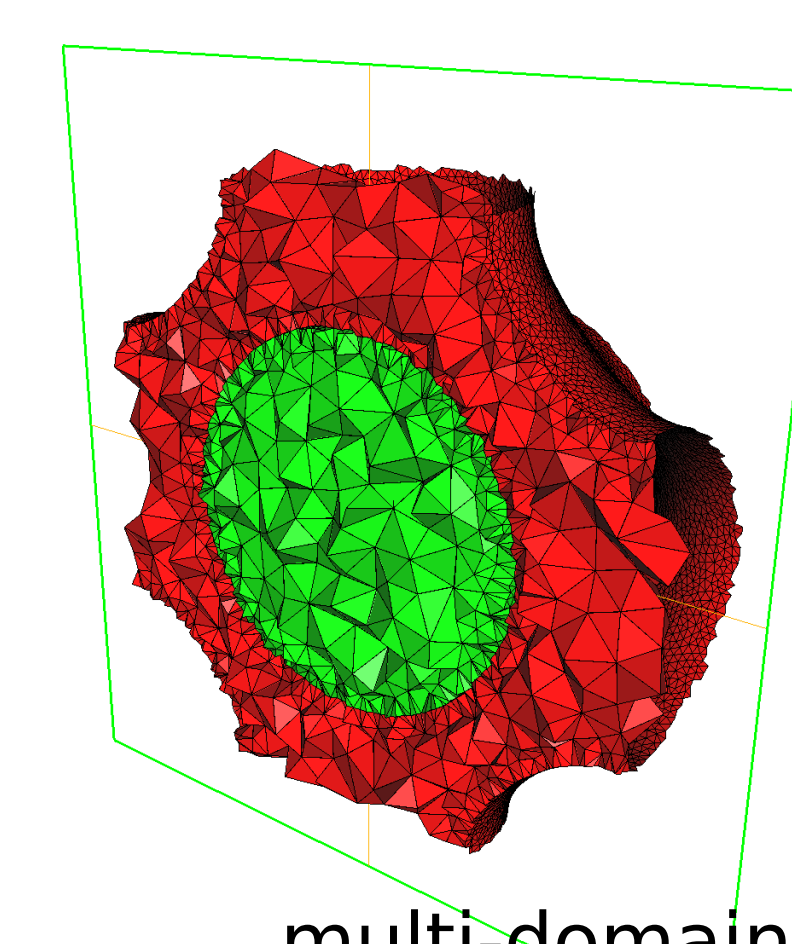
periodic copies
fit together



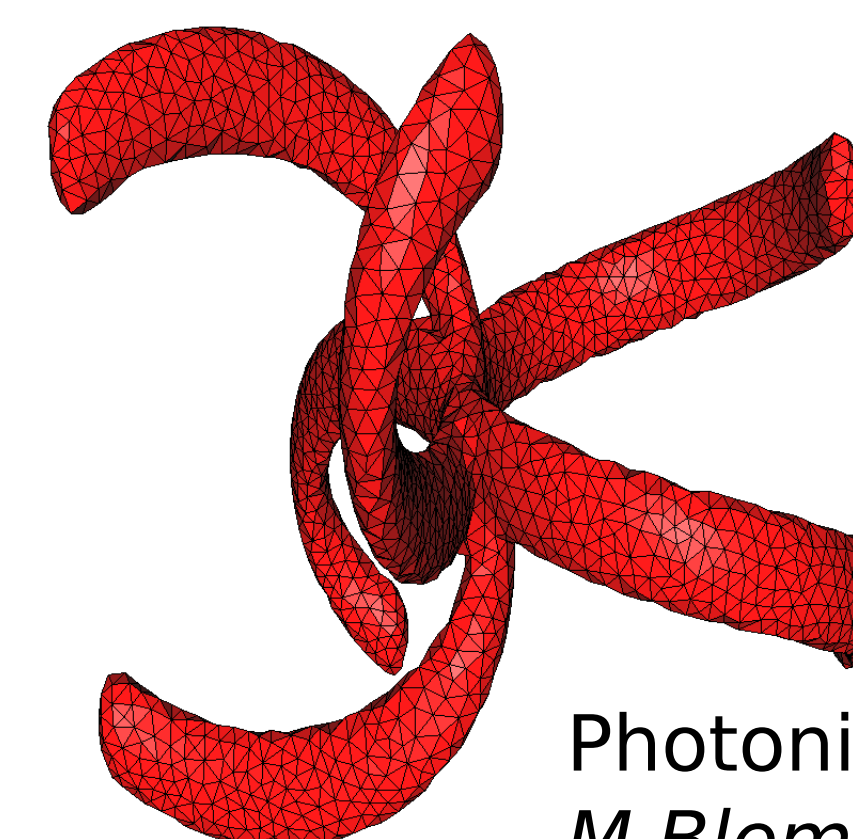
interior



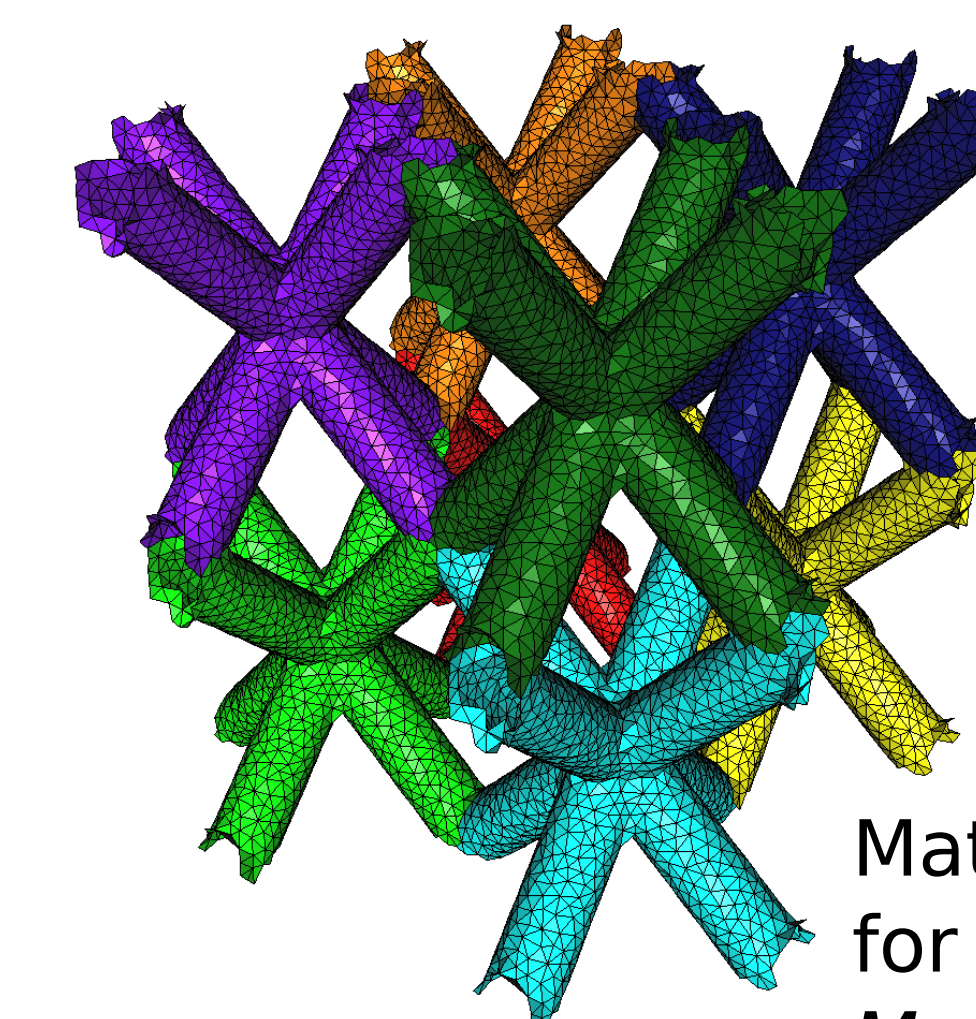
interior and exterior



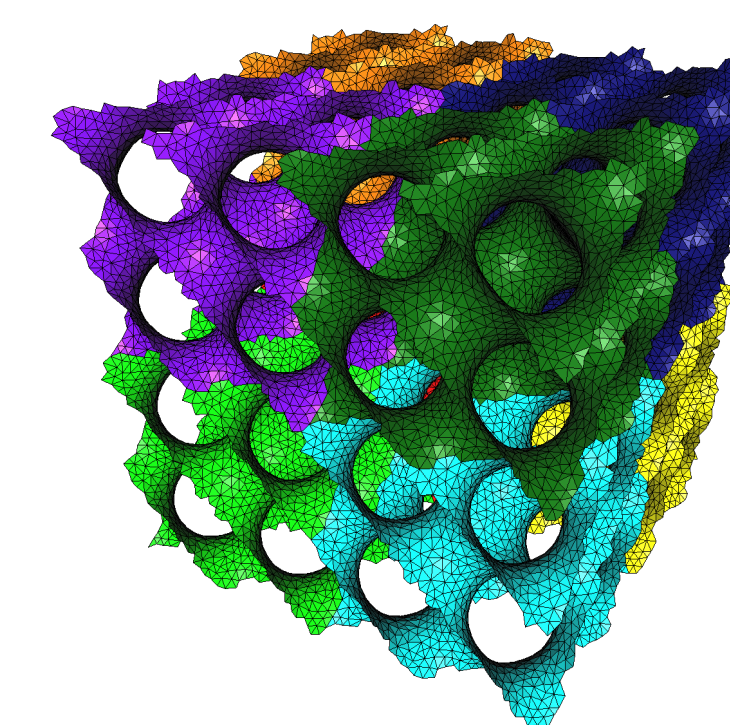
multi-domain
and sizing field



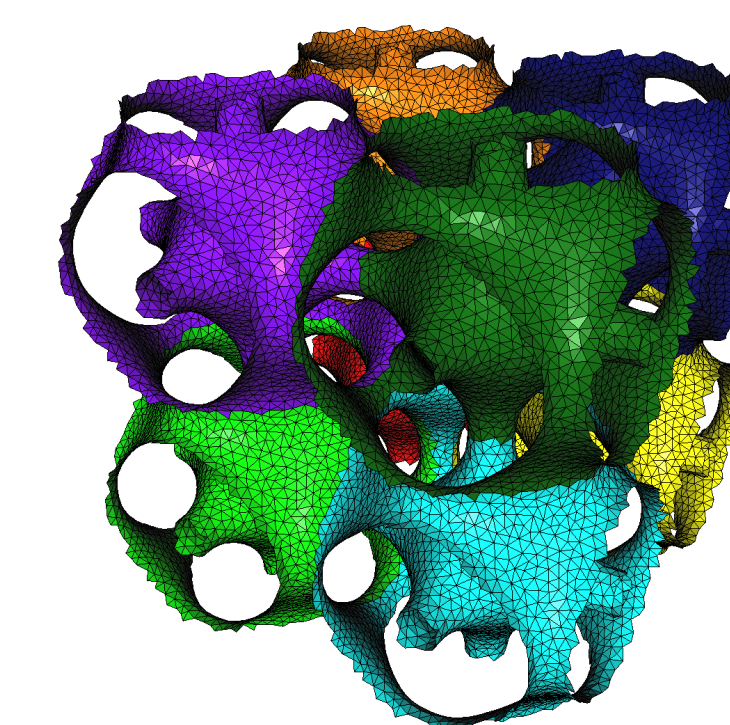
Photonic crystal
M. Blome
Zuse Institute Berlin



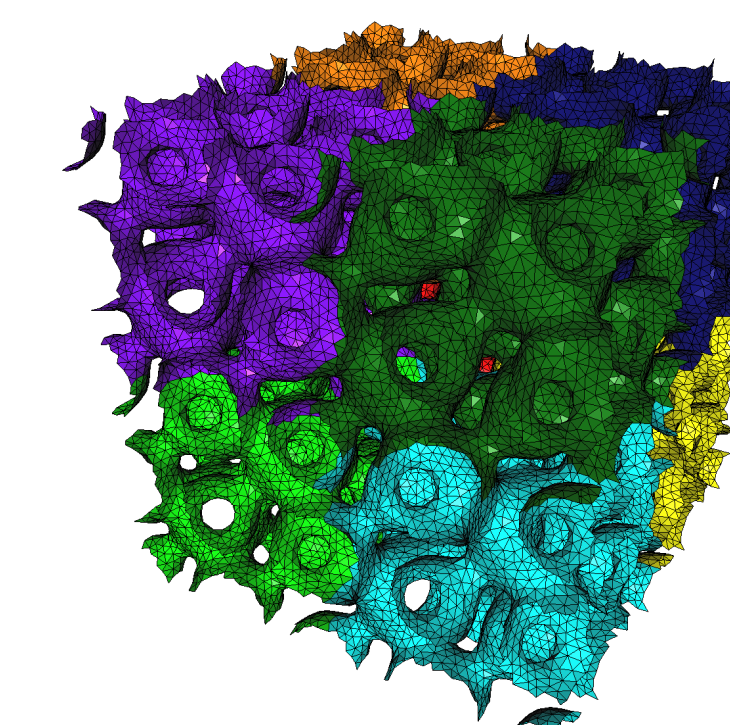
Material
for bone scaffolding
M. Moesen
K.U. Leuven



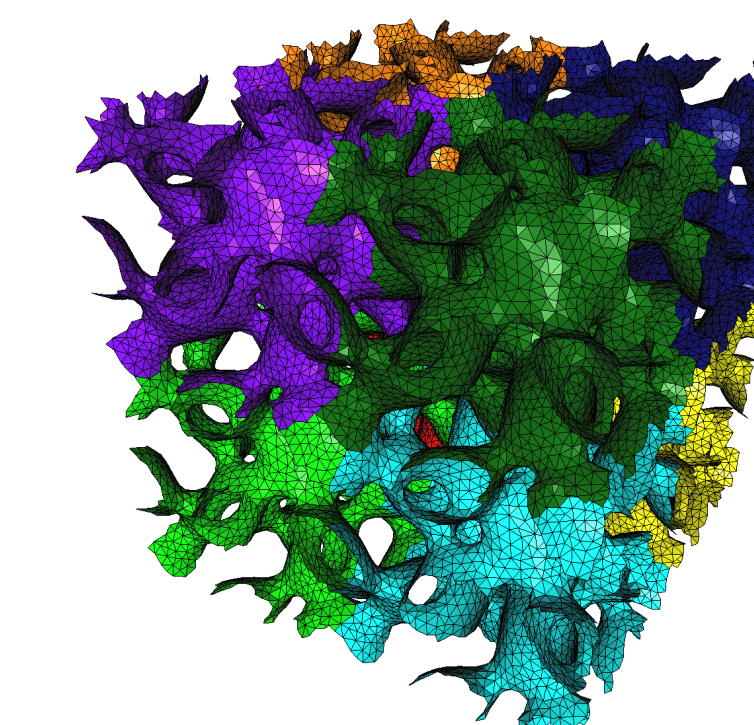
Diamond



Double p



D prime



Lidinoid

References

- [CT09] Manuel Caroli and Monique Teillaud. Computing 3D Periodic Triangulations. In *Proc. 17th ESA*, LNCS 5757, pp 37-48, 2009.
[RY07] Laurent Rineau and Mariette Yvinec.
A generic software design for Delaunay refinement meshing. *Comput. Geom. Theory Appl.*, 38:100-110, 2007.
Meshing 3D Domains Bounded by Piecewise Smooth Surfaces. In *Proc. IMR*, pp 443-460, 2007.

Acknowledgments

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<http://www-sop.inria.fr/members/Monique.Teillaud/ADT-OrbiCGAL/>